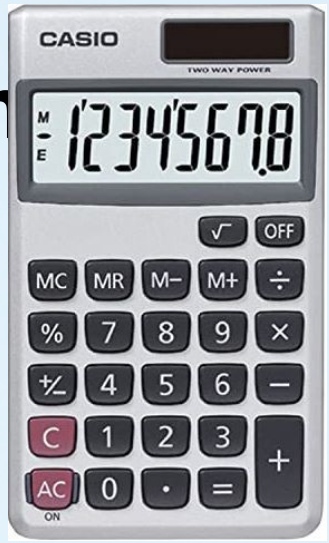
Solar Power

Noji Ratzlaff
KNØJI
noji.com/hamradio

Many applications

Used everywhere there's sun
Becoming more universal
Becoming less expensive

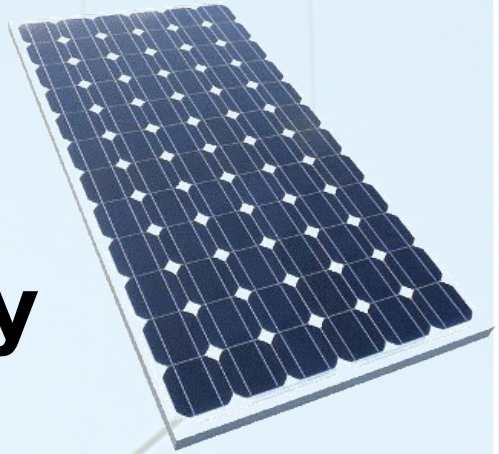


Requires three components

Solar panel

Charge controller

Rechargeable battery



Solar cell types

Silicon – about 16% efficient

Most common on homes, inexpensive

Polycrystalline – about 18% efficient

Common on homes, more expensive

Monocrystalline – about 23% efficient

Becoming more common, most expensive

Thin film – about 13% efficient

Small appliances, least expensive

(phone charger, small lights, calculators, etc.)

Your charge controller is key

Regulates the voltage

Controls the current

Adjusts to the battery type

Can run 24/7

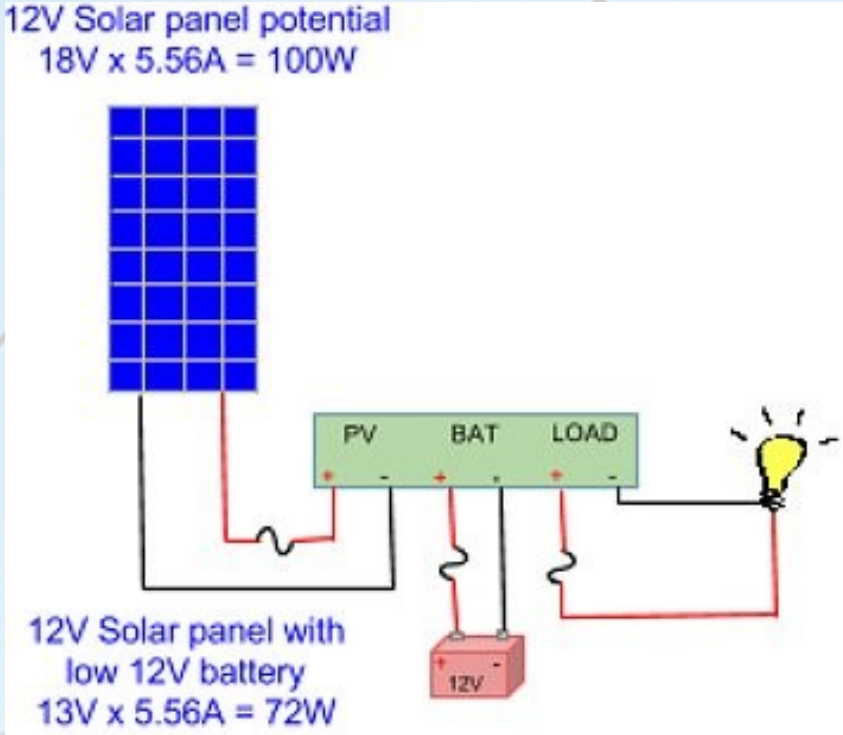
PWM or MPPT

Never connect a panel to a battery without one

Do not connect charge controllers to each other

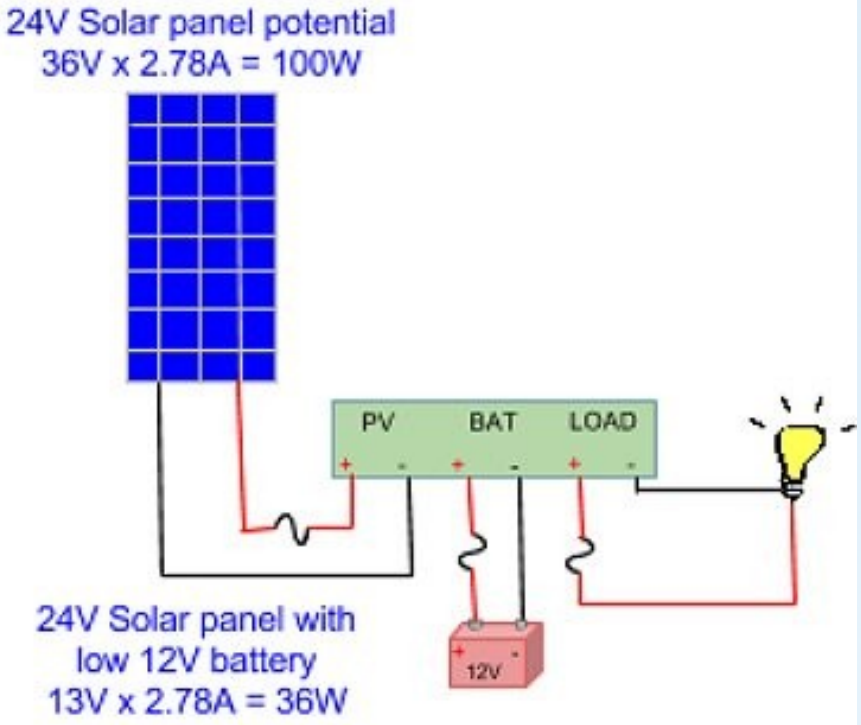
PWM charge controller

Less expensive



12V Solar Panel with PWM charge controller charging a low 12V battery

28% loss

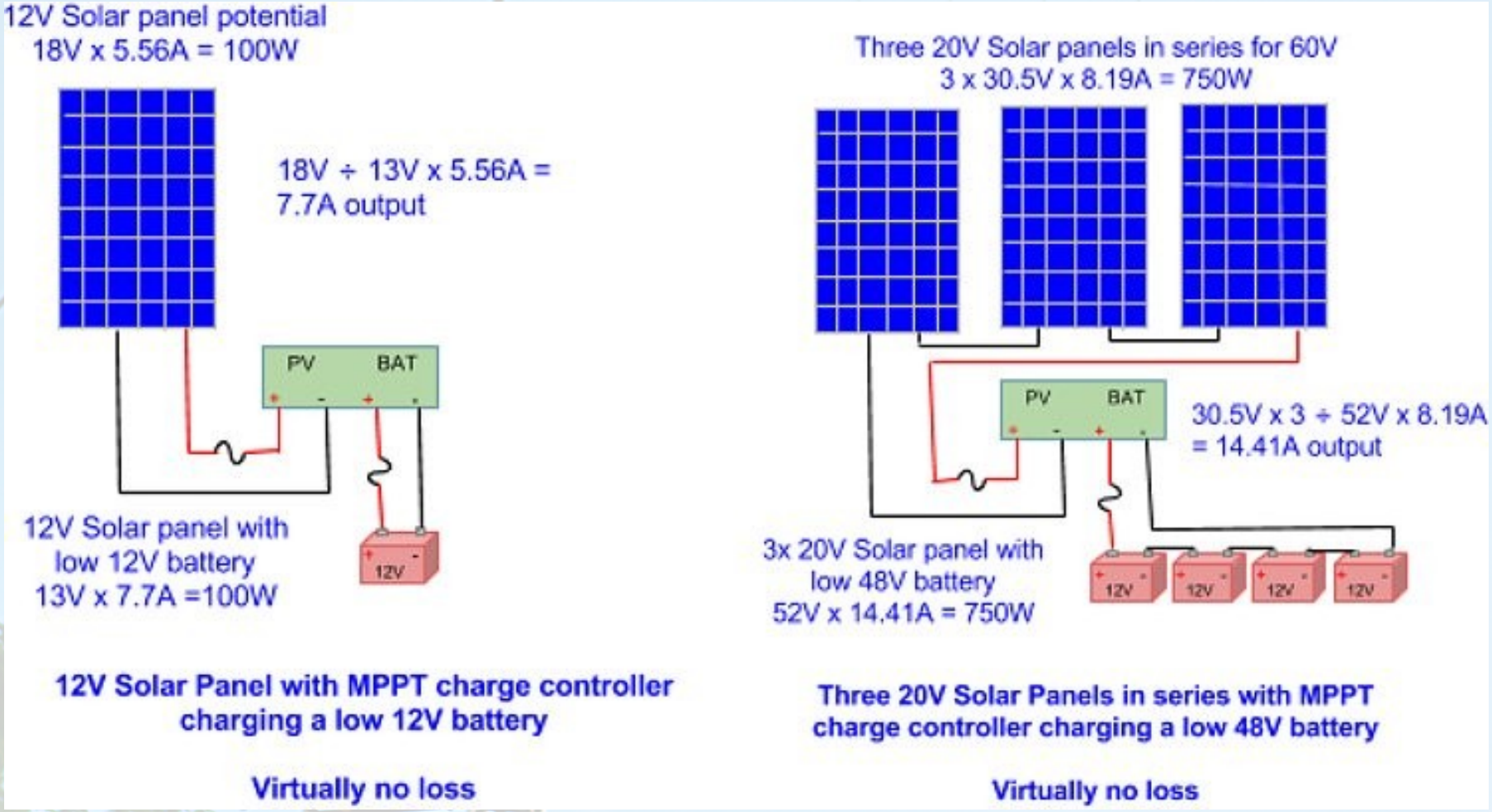


24V solar panel with PWM charge controller charging a low 12V battery

64% loss

MPPT charge controller

More efficient



Load the controller

- It’s best to apply the load to the controller
- It’s ok to apply the load to the battery
- ***Do not appl***

Battery type

Use a deep-cycle battery, if available

Today's battery types includ

- **SLA**
- **AGM**
- **Li-Ion**
- **LiPo**
- **$LiFePO_4$**

Battery practices to avoid

Do not connect batteries together

- **of different nominal voltages (12 V / 24 V)**
- **of different types (AGM / SLA / $LiFePO_4$)**
- **of different capacities (Ah)**

Do not leave batteries charging forever

- **unless you're using a smart charger**

Do not dispose of batteries in your trash

Do not keep batteries that show any signs of leaking or bloating

Connectors

- Many solar panels come with MC4 connectors
- I tend to convert them all to Andersons

Put it all together

Multiple panels

- Can connect them in parallel if they have the same output voltage, to increase wattage
- Can connect them in series, to increase voltage
- Try and connect ***identical panels*** together; different (wattage, chemistry) types ***can*** work together, if you know what you're doing (similar open-circuit

Just how much do you need?

- Yaesu FT-857D (maximum 23 A, but only being used at 50% duty cycle) = 11.5 A (average)
- LDG AT-100Proll tuner = 0.5 A
- Laptop (charger and inverter) = 6.6 A
- LED light stick (for nighttime work) = 0.2 A
- Total draw = 11.5 + 0.5 + 6.6 + 0.2 = 18.8 A
- You will need 18.8 A x 12 V = 225.6 W
- Energy required for one hour = 225.6 Wh

Your power calculation

Energy required for one hour = 225.6 Wh

Assuming a 75% solar (PWM) solution, you'll need a 225.6 Wh ÷ 0.75 = 300 W solar panel charging your battery for an hour

Or a 100-watt panel charging for three hours

For three operating hours, you'll need a battery that can handle 18.8 A x 3 hours = 56.4 Ah

But to keep the battery from draining too far, use a 100 Ah deep-cycle battery to provide 56.4 Ah

Your charge controller needs to handle 18.8 A, so I recommend a 30 A controller

Your shopping list

Basic needs, not including cabling

- **One 100 W solar panel**
- **One 100 Ah battery**
- **One 30 A PWM 12 V charge controller**

Alternatively,

- **Two 50 W solar panels**
- **Two 50 Ah batteries**
- **One 20 A MPPT 12 V charge controller**

Now, go have some fun

Will this work on a cloudy day?

- **Outdoors, yes; indoors, maybe not so much**

Where can I purchase these things?

- **Amazon smile (smile.amazon.com)**

Where can I dispose of old batteries?

- **Interstate Batteries, Batteries Plus**

How can I get rid of working solar panels?

- **Give them to Noji**